DOCUMENT RESUME

ED 440 295 CE 080 068

AUTHOR Losh, Charles L.
TITLE Using Skill Standards for Vocational-Technical Education Curriculum Development. Information Series No. 383.
INSTITUTION ERIC Clearinghouse on Adult, Career, and Vocational Education, Columbus, OH.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 2000-00-00
NOTE 60p.
CONTRACT ED-99-CO-0013
AVAILABLE FROM Center on Education and Training for Employment, 1900 Kenny Road, Columbus, OH 43210-1090 (Order No. IN383, $8.50). Tel: 800-848-4815, ext. 24277 (Toll Free); Fax: 614-292-1260; Web site: http://cete.org/products/index.html. For full text: http://www.ericacve.org/fulltext.asp.
PUB TYPE Guides - Non-Classroom (055) -- ERIC Publications (071)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Competence; Criterion Referenced Tests; *Curriculum Development; *Job Skills; *National Standards; *Performance Based Assessment; Postsecondary Education; Secondary Education; *State Standards; Technical Education; *Vocational Education
IDENTIFIERS *Scenarios

ABSTRACT

This guide provides assistance to state and local vocational-technical educators in the development of curriculum that is based on national and state skill standards that use workplace-derived measures of competent performance to prepare students for the work world. The guide begins with guidelines for determining the usefulness of existing standards sets, including criteria for evaluating their validity, the performance indicators used, the credibility of the developers, and civil rights concerns. The following typical steps in the process of developing standards-based curriculum are then discussed: (1) conduct a needs analysis; (2) obtain a set of national, state, or business-industry skill standards; (3) establish a program advisory committee; (4) review the skill standards set to identify vocational-technical program content; (5) develop an assessment process and instrumentation; (6) develop, adapt, or adopt instructional materials; and (7) review and revise curriculum on an ongoing basis. The last section of the guide describes how to develop scenario-based instruction through the use of a scenario planner and development and review rubric. Appendixes contain sample skill standards, model scenarios, a checklist for instructional and assessment criteria, a sample scenario planner, and a blank master. (Contains 22 references.) (KC)

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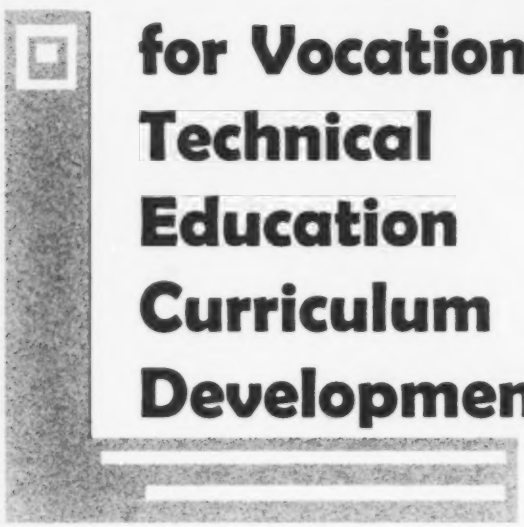

Information Series No. 383

by Charles L. Losh

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Using National and State Skill Standards for Vocational-Technical Education Curriculum Development

Information Series No. 383

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2000

Funding Information

Project Title:	ERIC Clearinghouse on Adult, Career, and Vocational Education
Contract Number:	ED-99-CO-0013
Act under Which Administered:	41 USC 252 (15) and P.L. 92-318
Source of Contract:	Office of Educational Research and Improvement U.S. Department of Education Washington, DC 20208
Contractor:	Center on Education and Training for Employment The Ohio State University Columbus, Ohio 43210-1090
Interim Executive Director:	W. Michael Sherman
Disclaimer:	This project has been funded at least in part with Federal funds from the U.S. Department of Education under Contract No. ED-99-CO-0013. The content of this publication does not necessarily reflect the views or policies of the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.
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Foreword

The Educational Resources Information Center Clearinghouse on Adult, Career, and Vocational Education (ERIC/ACVE) is 1 of 16 clearinghouses in a national information system that is funded by the Office of Educational Research and Improvement (OERI), U.S. Department of Education. This paper was developed to fulfill one of the functions of the clearinghouse interpreting the literature in the ERIC database. This paper should be of interest to vocational education teachers.

ERIC/ACVE would like to thank Charles L. Losh for his work in the preparation of this paper. Dr. Losh is Director of Product Development, Vocational-Technical Education Consortium of States, where he has also served as Chairman of the Board. Previously, he was Deputy Associate Superintendent and State Director of Vocational Education in Arizona. He is the editor of the American Technical Association's ATEA Journal and author of Linking Academic and Occupational Skill Standards, published by the Southern Association of Colleges and Schools.

The following people are acknowledged for their critical review of the manuscript prior to publication: Steven Klein, Senior Researcher, MPR Associates; John Tippie, Associate Director, West Coast Operations, Laborers-AGC Education and Training Fund; Lowell E. Hedges, Associate Professor Emeritus, the Ohio State University; and Rebecca A. Parker, Research Specialist 1, Center on Education and Training for Employment. Susan Imel coordinated publication development. Sandra Kerka edited and formatted the manuscript.

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Executive Summary

In the 1990s, skill standards initiatives at the federal level have been spurred by the National Skills Standards Projects sponsored by the U.S. Departments of Education and Labor and the establishment of the National Skill Standards Board in 1994. However, the standards movement in the United States includes more than 25 years of curriculum development by state curriculum centers and numerous curriculum projects and programs. This paper was developed to provide assistance to state and local vocational-technical educators in the development of curriculum based on national and state skill standards. It provides guidance and models for using these workplace-derived measures of competent performance in the preparation of students for the world of work.

The paper begins with guidelines for determining the usefulness of existing standards sets, including criteria for evaluating their validity, the performance indicators used, the credibility of the developers, and civil rights concerns. The typical steps in the process of developing standards-based curriculum are discussed:

- Conduct needs analysis
- Obtain a set of national, state, or business-industry skill standards
- Establish program advisory committee
- Review skill standards set to identify vocational-technical program content
- Develop assessment process and instrumentation
- Develop/adapt/adopt instructional materials
- Review and revise curriculum on an ongoing basis

Derived from the real world, skill standards provide a natural content base for contextual instruction. Standards-based scenarios provide a rich context for the integration of academic and vocational education. The last chapter describes how to develop scenario-based instruction through the use of a scenario planner and development and review rubric.

The appendices contain sample skill standards, model scenarios, a checklist for instructional/assessment criteria, a sample scenario planner, and a blank master.

Information on using skill standards for curriculum development may be found in the ERIC database using the following descriptors: Competence, Criterion Referenced Tests, *Curriculum Development, *Job Skills, *National Standards, *Performance Based Assessment, *State Standards, and Vocational Education, and the identifier *Scenarios. Asterisks indicate descriptors that are particularly relevant.

Introduction

The standards construct has achieved a life of its own during the 1990s. The collaborative efforts of business and industry moguls and state governors to improve academic performance and international competitiveness have resulted in a plethora of standards of all kinds and of varying quality. There are two types of education and training standards, those dealing with student academic skills and those that address occupational skills (broad or narrow) relating to work requirements. In this monograph, standards that address work-related skills are labeled skill standards.

Standards developers include the National Skill Standards Board (NSSB) convening groups at the federal level, state-level groups setting academic and skill standards, and local developers of academic standards. Numerous publications address the multiplicity of academic standards. For those with an interest in learning more about the status of the academic standards movement, the U.S. Department of Education's regional education labs such as the Mid-Continent Research for Education and Learning Laboratory (MCREL) <http://www.mcrel.org/> and the Northwest Regional Education Laboratory (NWREL) <http://www.nwrel.org/> have extensive information on academic standards initiatives as well as links to other pertinent sites. Information on all ongoing and past academic standards initiatives can be located through these centers.

The term "skill standard" has surfaced relatively recently as a focus of state and national efforts. Prior to these initiatives, although standards of competent skill and task performance were identified and used in curriculum development, skill standard terminology was not used in the development of vocational-technical education curriculum. The concept of standards, however, has been in place in education and vocational-technical education since the 1960s. Most educators would recall these early standards initiatives as behavioral or performance objectives like those established by Mager (1962). Behavioral objectives include the performer (a student), the action or behavior (a task or skill), and the criteria for competent performance of the behavior (a standard).

Skill standards initiatives at the federal level began with the 22 National Skill Standards Projects sponsored by the U.S. Departments of Education and Labor in 1993. The results of these projects are sometimes called national skill standards, but this is true only if they are endorsed by a recognized national business, industry, or labor organization.

The major national activity in this field was the establishment of the National Skill Standards Board (NSSB) in 1994. The NSSB represents business, labor, employees, education, and community and civil rights organizations overseeing the development of a voluntary national skill standards system, including assessment and certification. The NSSB does not develop or endorse standards. This work is actually conducted by groups of individuals called convening groups, which will establish "voluntary partnerships" that reflect the organization of the

board. These voluntary partnerships are the national standards endorsing entity under the NSSB umbrella. The convening groups are charged with identifying standards for the "core" and at least one "concentration" area. For further definitions and information on the activities of the NSSB and the present status and number of voluntary partnerships, see their website <http://www.nssb.org/>.

In addition to activities at the national level, the standards movement at the state level includes more than 25 years of curriculum development by state curriculum centers and numerous curriculum development projects and programs. Numerous materials in the ERIC database and other publications document these activities in the United States and internationally. One example of a long-term standards development group, the Vocational-Technical Education Consortium of States (V-TECS), has analyzed occupations since 1973, identifying tasks and standards that are used for vocational curriculum development by member and nonmember states.

Skill standards are generally associated with an industry or occupation, or some subset or combination of these. For many years, skill standards have been and are being developed by business, industry, and labor organizations identifying worker skills in specific occupations. Well-known examples of this type of standards include the National Institute for Automotive Service Excellence (ASE) standards for automotive technicians, the American Welding Society (AWS) standards for welds made by certified welders, and numerous apprenticeship standards.

For the purposes of this monograph, a skill standard is defined as follows:

> an operational definition of competent performance, stated in such a fashion that an expert in the area of interest can determine competent vs. noncompetent performance, and peers agree on the judgment of the expert. The stated level of performance must not be ambiguous, and experts in the area must be able to understand the statement.

Academic standards have been and are being developed at the national, state, and local level. Examples of national academic standards include the Curriculum and Evaluation Standards for School Mathematics, published by the National Council of Teachers of Mathematics in 1989, and the efforts of the National Science Teachers Association and the American Association for the Advancement of Science standards initiatives. Other national academic standards have been produced by various groups, with mixed results. Nearly all states have established state academic content standards, and many have an associated assessment process.

One of the premier organizations working in the academic standards arena is MCREL. The work of researchers in that organization relating to national, state, and local academic standards is exemplary. On their website < http://www.mcrel.org/standards/> are numerous materials relating to academic stan-

dards, with ***The Fall and Rise of Standards-Based Education***, by Robert J. Marzano and John S. Kendall (1999), providing an excellent overview of the standards movement in education and identifying the significant challenges in implementing a standards-based delivery system at the school level. Specifically, they state:

> In short, a state, school or district wishing to establish standards based on the national documents must first identify what they mean by a standard and the format their standards will take. Next, they must systematically analyze all the national documents translating them into a format and conceptual base compatible with their own. This, of course, can be a labor-intensive endeavor that requires valuable resources of a variety of types. (p. 32)

Their discussion of various types of standards is very helpful to practitioners attempting to differentiate them. As an example, in their discussion of content and performance standards they state:

> In other words, a content standard is a statement of the knowledge or understanding we would expect students to have. On the other hand, a performance task describes a specific use of knowledge and skills: it is not a description of knowledge, but a description of some application of it. (p. 38)

They go on to quote the National Education Standards and Improvement Council (NESIC):

> As the National Education Standards and Improvement Council notes:...performance standards indicate "both the nature of the evidence (such as an essay, mathematical proof, scientific experiment, project exam, or combination of these) required to demonstrate that content standards have been met and the quality of student performance that will be deemed acceptable" (NESIC 1993, p. 22). (p. 40)

The advice of Marzano and Kendall (1999) relative to definitions and formatting certainly pertains to the use of skill standards in the development of vocational-technical curriculum, as is discussed in the next section of this monograph. In the skill standards arena there are significant definition issues, and the user of skill standards must be aware of these caveats.

The standards arena can be quite confusing to individuals who do not develop or use standards on a regular basis (and unfortunately, in many cases, it can be confusing to all but the developer of the standards set under review). The next section of this monograph includes discussion and criteria to help irregular users of standards sort through standards quality issues. As in most fields, the use of terms conveys specific meanings to experienced skill standards developers. The skill standards movement has led to a plethora of skill standards developers, some more experienced than others. This has resulted in the use of the same term with multiple meanings, with "standards" being the most problematic.

Many ad-hoc standards development activities have occurred during the past 20 years, including business and industry materials, national efforts, and some significant state initiatives. As in other arenas, states have developed unique approaches to standards development, resulting in curriculum and standards that have (in many cases) quite different approaches to the concept of a "standard." For potential standards users, a quality checklist is included for the review of standards sets to determine their utility for instructional material development.

Skill standards are generally associated with skills required by workers on the job in business and industry, as opposed to academic standards for student performance, although there is a significant interrelationship between academic and skill standards. In addition to technical considerations relating to standards use in curriculum development, this monograph provides specific guidelines and models for developing student use materials from skill standards.

Caveat Emptor—Determining the Usefulness of Skill Standards

It would be helpful to readers of this monograph and users of skill standards if there were a taxonomy or other definitive, commonly accepted set of definitions of skill standards, standards based, standards movement, standards sets, and other standards-related terminology. However, no such commonly accepted definitional tool exists. For new users, as well as those who have been involved in developing skill standards or using skill standards for curriculum development, this can be confusing.

Skill standards, however, come in many sizes and shapes, have no consistent definitional base, and include diverse degrees of content. Skill standards are generally, but not always, developed with input from individuals representing business and industry, organized labor, and education/training. Some skill standards have all of these stakeholders represented, some do not. Some skill standards are developed by individuals that are experienced in skill standards development, most are not. Therefore, caveat emptor let the buyer (user) beware. This section identifies and discusses elements and issues the curriculum developer must attend to prior to adopting any set (organized collection of skill standards that are related in a meaningful manner) of skill standards.

What Is a Skill Standard?

As indicated earlier, there is no common, universally accepted definition of a skill standard, nor common usage of the term standard. Many definitions of a skill standard exist. Pearlman (1997), writing in Transitions in Work and Learning, states that—

> Skill is not a unitary concept. In fact, there is currently no single, generally accepted definition of "skill" in the professional or scientific literature. The term has been used to refer to a wide range of personal characteristics, traits, work preferences, broad aptitudes, basic abilities, generic competencies, specialized skills, and specialized knowledge, creating a contemporary tower of Babel in that the same terms are often used to denote different classes of skills and different terms are often used to denote the same classes of skills. This lack of an accepted vocabulary or a "commons skills language" has been a major obstacle to developing appropriate strategies for addressing many critical skills issues, such as transferability, gaps, and the setting of standards. (p. 143)

Klein, Cuccaro-Alamin, Hoachlander, Giambattista, and Ward (1997) observe: Presently, state policymakers and industry groups are using a variety of frameworks to define skill standards. Additionally, inconsistencies in standard format and specificity and a lack of supporting materials for educators often result in a failure to readily translate skill lists into classroom practice. (p. 2)

Among the groups defining skill standards, and one that would be expected to have an impact on the definitional discussion, is the National Skills Standard Board (NSSB). The NSSB (1998) defines skill standards as—

> The array of work- and worker-oriented information that specifies the critical work functions, key activities, performance standards, skills, and knowledge required to successfully perform in a given occupation or field, and which includes an assessment plan specifying the type and level of performance required for certification on the skill standards. In simple terms, a skill standard specifies what one needs to be able to do and how well one needs to be able to do it. (p. 65)

According to Pearlman (1997):

> The basic concept of a skill standard implies a translation or an association between a given skill level of a person and a given performance level on a job. This implies the need for a number of things, such as the following: (1) definition of the target performance (task or skill cluster) to which a skill standard will be addressed (with special consideration given to the narrowness or broadness with which such performance is defined), (2) determination of the worker attributes related to performance of the defined task or task cluster, (3) reliable and valid means of measuring performance on the defined task or cluster, (4) reliable and valid means of measuring the performance-related attributes, (5) specification of various levels of performance against which the performance-related attributes will be benchmarked, and (6) specification of the levels of performance-related attributes associated with these performance levels. (p. 168)

While discussing standards and different types of standards, the authors of Cross-Industry Assessment and Certification (National Skill Standards and Assessment Collaborative 1998) state that—

> A standard is an explicit statement that clearly defines the knowledge and skills and the level of performance expected of an individual in a given content or work area. As a set, standards represent consensus among stakeholders on what is most important for individuals in a field (of study or work) to know and be able to do. (p. 16)

They also identify two different types of standards, content standards and performance standards:

> Content standards identify the areas of knowledge, understanding, and skills which are expected to be learned by individuals in key subject and career areas Performance standards define and illustrate levels of expected accomplishment with respect to one or more content standards. (p. 17)

From these definitions, one would conclude that a skill standard must include both content and performance elements.

According to Klein et al. (1997):

> This confusion about terminology is contributing to the development of inconsistent national and state industry standards. To date, standards that have been defined vary in their breadth and specificity, meaning that industry skills often have few similarities, across, and sometimes within, states. (p. 3)

Given this variance, specific questions relating to the validity of any given set of standards have been developed for this paper, along with a matrix checklist in the next section.

Is the Standards Set Valid?

Validity is a critical characteristic of standards that are to be used for education/training and certification purposes. Historically, validity concerns have been related to testing and measurement, but the concept also affects the development process for skill standards.

The NSSB (1998) provides the following definition of validity:

> Generically, the degree to which inferences based on scores from an assessment are accurate. There are a number of professionally recognized forms of validity and methods for gathering and documenting evidence of validity including content validity, criterion-related (predictive and concurrent) validity, and construct validity. Content validity refers to evidence that an assessment represents an adequate sampling of the performance, skill, or area of knowledge to which it is targeted; such evidence is established on the basis of various characteristics of the assessment tool development process itself. Criterion-related validity refers to evidence that assessment scores are empirically related to one or more relevant or important components of work performance. Construct validity refers to evidence that an assessment measures one or more inferred worker traits or other characteristics shown to be important for effective work performance. (p. 66)

For skill standards purposes, content validity is the only concern. Content validity is established by documenting the process followed in developing the standards

and by ensuring that the content of the standards accurately reflects the domain (occupation, cluster, or industry) of interest.

> **Decision criteria**: Documentation from the skill standards developer must assure that the skills represented in the set were reviewed and approved by adequate numbers of expert workers (at least 50) in the occupation(s) represented by the standards.

Skill Standards Performance Criteria

Does the standard set clearly indicate (for each skill) the determinants of competent performance? A standard, by definition, identifies what does or does not constitute adequacy. In the case of a skill standard, the standard must identify evaluation criteria to determine an acceptable level of performance, or in some instances, indicators of noncompetent performance. If no standard of performance is apparent, then clearly, there is no usable "skill standard."

There continues to be much discussion of exactly how to indicate levels of performance, including issues related to time required to perform, quantity of performance (product or process), and "quality" of performance (the most difficult to define). In any case, a skill standard, for purposes of this discussion, must relate "an operational definition of competent performance," stated in such a fashion that an expert in the area of interest can determine competent vs. noncompetent performance, and peers agree on the judgment of the expert. The stated level of performance must not be ambiguous, and once again, experts in the area must be able to understand the statement.

> **Decision criteria**: Skill performance determinants must be included in the skill standards under review, stated to such a degree that a valid performance assessment can be developed for skills in the standards set. If not, the standards set is of limited value, and the curriculum developer will need to continue the review of standards sets from other developers.

Ask the Right Questions—Ask the Right People

In many instances, it is assumed that if the standards set gives an indication of having been developed and validated by business, industry, and labor representatives, it automatically means that the standards are of high quality and valid. This conclusion, one based on conventional wisdom, is not necessarily accurate. Skill standards generally reflect the skill, knowledge, and analysis experience of the individual leading the standards development project, not the validation group. Standards statements can be long or short, have much or little content, performance can take very little or a very long time, and numerous other elements come into play during the standards development process. Each standard must be essentially the same "size," or contain a like amount of performance content. Standards that include multiple performances are very difficult to measure, given the complexity of the required assessment.

Standards developers who ask business, industry, and labor representatives to validate the standards sets may not realize that, although incumbent workers may indicate that a skill is performed, the workers have no intrinsic way of knowing whether the skill is comparable in content to other skills. One of the primary problems is attempting to identify a standard for a skill when the skill is only a performance element in another standard. Occupational analysis and group leadership skills are critical elements of the standards development process. Many state and local skill standards sets (primarily task lists) are developed using the DACUM (Developing a Curriculum) process, and skill and experience levels among DACUM analysts vary greatly.

Incumbent workers, those presently working in the occupation, are the only ones who actually know and can provide information on the skills performed by workers in the occupation or industry and on the associated levels of acceptable performance. However, they must be led through a series of group question-and-answer processes to determine if the standards are adequate. In most instances, vocational instructors should not be identified as part of the skills standard development team, since they find it difficult to differentiate between the work-based skill and how it is taught in their class.

> **Decision criteria**: The skill standards set must include information on the standards development system followed during the development process, and should have information on the developers experience. If evidence of developer experience is nonexistent or weak, then experts in the occupational area need to be consulted to determine if the skill standards set is useful as a valid base for curriculum development.

Civil Rights Concerns

Curricula developed using standards or any other resources must ensure that individuals' civil rights are not violated by implementation of the resulting curriculum. Racial, cultural, or gender bias must not be apparent in the skill standards set.

> **Decision criteria**: Ensure that the standards have no reference to race, color, creed, national origin, or gender.

Skill Standards Checklist

Skill Standards Set Characteristic	Yes	No
1. Skill Standard (SS) set is endorsed by appropriate business/industry.		
2. Each SS skill includes specific standards of acceptable skill performance.		
3. SS set development process is documented.		
4. Number and types of incumbent workers participating in the SS set development and validation are indicated.		
5. An Internet address is included for further information on and updates of the SS set.		
6. SS set is not biased.		

Appendix A includes several examples of skill standards that have been developed by various entities. These are not all good examples of skill standards. They do, however, demonstrate the difficulty in obtaining high-quality skill standards that curriculum developers can readily use to develop instructional materials for student use. One of the major difficulties with many skill standards is the lack of performance standard criteria. Without specific criteria, the standards simply become a list of skills, generally mixed to a degree that precludes the development of related performance assessments. If item number two in the checklist is missing, then the curriculum developer is advised to look for a more complete set of applicable standards.

Developing Standards-Based Curriculum

Skill Standards and Instructional Design

For the purposes of this monograph, curriculum is defined as instructional materials developed for student use in the classroom, laboratory, or shop. It is assumed that the curriculum will be designed to address a specific set of validated skill standards that meet the criteria adopted by the curriculum developer.

The basic element of a standards-based curriculum is a set of skill standards validated by incumbent workers in the industry or occupation(s) addressed. To be usable for curriculum development, the skill standards must be specific and have performance indicators.

Standards-based curriculum development is an instructional design process that uses a systematic content identification and delivery procedure. The primary elements include business-industry-labor validated skill standards that identify standards of competent performance and an associated assessment system. The primary difference between standards-based and nonstandards-based curriculum development is the use of an industry-determined standard, as opposed to one derived by educators.

The standards movement has not had a significant impact on the curriculum development process, despite efforts of various standards developers. Numerous states and multistate consortia have developed curriculum using a standards- or task-based process for more than 25 years. Although in the 1960s and 1970s many states had functioning curriculum development centers, today the number of states that develop student-use curriculum materials is very limited. At the state level, Missouri, Ohio, and Oklahoma still provide financial support for student-use curriculum development. Other states, especially small states with less federal funding, have gotten out of the curriculum development business. The most well-known example of a long-term, multi-state curriculum development consortium is the Multistate Academic and Vocational Curriculum Consortium (MAVCC), which began in 1973. This consortium of states joined together to develop student-use materials for programs with limited enrollment in the members' states. Today, however, MAVCC <http://www.mavcc.org> curriculum addresses many areas commonly found in the vocational delivery system in states across the nation.

With the change in graduation requirements fostered by the publication of A Nation at Risk (National Commission on Excellence in Education 1983), classic vocational programs designed for occupation-specific preparation have disappeared from many states. The emphasis on increased academic content has led to two very significant changes in the content of vocational programs. The first change is the increased emphasis on the integration of academic and vocational

education content, and the second change is the move to broader skill preparation. These broad areas are known as career pathways, career clusters, career academies, or by some title connoting preparation for a career, as opposed to preparation for a specific occupation.

Curriculum development for career clusters or pathways is somewhat more complex, given that the cluster is defined by the educational philosophy of the developer. Therefore, in most instances the content of the curriculum will depend on developmental decisions, as opposed to occupational requirements. Given this variance, nonoccupationally specific curricula will draw skills from multiple standards sets.

A potential solution to the career cluster development dilemma, however, is the NSSB objective of establishing skill standards for the "Core" and "Concentration" areas of an industry (for a full discussion of this topic see the NSSB website at http://www.nssb.org/). In theory, the Core Standards would apply across an industry, whereas the Concentration Standards would relate to a subset of several related occupations within the industry. The proposed Concentration Standards would have the closest relationship to a career cluster for curriculum development purposes.

One example of "Core" standards was developed by the Linking Academic and Occupational Skill Standards project (1998), and is available on their website <http://www.mfglinks.org/Rpt34_co.htm>. Generally speaking, it falls to the curriculum developer to select the specific skill standards to be included in a prevocational or clustered vocational program.

A potential benefit of standards-based curricula is the facilitation of tech-prep articulation agreements. Much has been written about tech-prep and articulation agreements. Suffice it to say, a standards-based curriculum facilitates tech-prep delivery, given the shared responsibility in delivering the curriculum. Skill standards sets provide a primary communication tool for tech-prep articulation, if the standards set has the necessary level of specificity.

Quality skill standards materials provide a base for program planning; comprehensive, valid, job-specific data for developing standards based curricula; information that assists in the identification of required program prerequisites; standards of acceptable skill performance; a basis for developing assessment systems; a tool for horizontal and vertical articulation; and a base (specific skills/tasks) for dialogue with industry to expedite the development of short-term training materials for new or expanding business/industry.

There are a number of models or systems for implementing standards-based curricula, and most systems include the following elements:

- Conduct needs analysis
- Obtain a set of national, state, or business-industry skill standards
- Establish program advisory committee
- Review skill standards set to identify vocational-technical program content

- Develop assessment process and instrumentation
- Develop/adapt/adopt instructional materials
- Review and revise curriculum on an ongoing basis

Conduct Needs Analysis

The first step in the development process is to conduct a needs analysis. This activity will indicate a demand (or lack of demand) for employees in the industry or occupation(s) that the skill standards represent. The needs analysis can be formal or informal; it involves the identification of employers in the area and the use of some type of survey (phone or mail) to determine the status of employment needs. Labor market data, gathered at the local or state level, provides projections of future employment along with training and wage data. At this stage of the development process, tech-prep program delivery should be a consideration.

Obtain Set of National or State Skill Standards

As indicated earlier, many state and national sources exist for skill standards. This situation is dynamic, and the advent of the Internet and availability of web-based resources makes the search process much easier and quicker. A search of the ERIC database using appropriate descriptors is a suggested initial activity (see the Executive Summary, p. vii, for suggested descriptors). State and national and business-industry skill standards listings and links can be found on such websites as the National Skill Standards Board <http://www.nssb.org/>, or the Virtual Scenario Tools™ <http://www.skillsnet.org/vtecs/index.htm>. A search at SkillsNet™ <http://www.skillsnet.org/ html/skillobjects.html>, will yield Skill Objects™, with standards sets designed to respond to skill training needs. Most websites have helpful links to other sites.

Establish Program Advisory Committee

The basic element in the curriculum development process is a business-industry advisory committee. An ongoing program is likely to have an existing advisory committee. If the program is new, then the administration and instructor must establish a program advisory committee that includes workers, labor, supervisors, and employers from the occupation or industry cluster under development.

The primary goal of the initial committee meeting is to identify the skill standards that local employers believe the curriculum must include. It is unlikely that most programs will be able to cover all the standards in a skill standards set, so selectivity is a requirement. One method is to identify skills that incoming or "entry-level" employees should be competent in performing. This group of skill standards must be in the curriculum, since skill training and practice on performing these skill standards will differentiate between the performance and productivity of a new employee hired "off the street" and one from a formal vocational-technical education program.

The next type of skills are those best learned on the job (work-based instruction), as opposed to school-based instruction. These are the skills that require specialized equipment, state-of-the-art equipment not available in the program, or skills that for other reasons are best acquired in the work environment.

The third level of skill standards would be the most complex skill standards performed by the experienced practitioner ones that most generally would be learned through extensive on-the-job experience or training programs offered directly by the business or industry.

Review Skill Standards Set to Identify Vocational-Technical Program Content

The theory or knowledge base for skill standard performance must be identified, since this will provide the link between skill standards in the occupation and transferability of knowledge to other occupations. Much of the theory and knowledge base in an occupation is usable throughout that occupation and in many cases, throughout the associated industry.

The majority of national and state skill standards are developed in such a manner that specificity relative to skills and knowledge is either not included, or is so broad as to be of little value. If the curriculum is to be shared state or system wide, then the academic and technical skills that back up performance must be clearly defined. One tool that has been used for academic analysis by multiple states is the Snyder/V-TECS Academic Skill Taxonomy (Arizona State University 1999), referred to in the remainder of this monograph as the Taxonomy. This taxonomy is used to identify the specific academic skills required for skill standard performance, and it can be linked to multiple states' academic content standards to demonstrate academic content. For a full discussion and identification of the associated analysis process see Linking Academic and Occupational Skill Standards (Losh 1998). Such states as Virginia, South Carolina, Maryland, Illinois, Arizona, Michigan, and Maine use this process to provide the ability to share standards based curricula. Numerous states including Ohio, Oklahoma, and Missouri have systematic processes to align their state content standards with their vocational curricula.

Develop Assessment Processes and Instrumentation

One thing to keep in mind relative to assessment is the business axiom that "What gets measured is what matters." For this reason assessment/testing drives curriculum content and, as indicated earlier, the presence of performance criteria or measures (the standard) for each skill is a critical step in selecting a standards set for use in curriculum development. If no performance criteria exist, then the development of valid assessments and related curricula becomes very difficult, requiring the identification of performance criteria prior to establishing an assessment process. Given that this is equivalent to revalidating the skills and identifying the standards, the need for standards with skills is reaffirmed.

Once the skill standards to be included in the program have been identified, the next step is to review (or develop) instruments to determine student mastery of the selected skills. To determine competent skill standard performance, there are many assessment processes that can be used. As indicated in The Status of Alternative Assessments through the 1990s (Bordeŕ 1998), numerous authors suggest that in addition to performance testing, criterion-referenced tests (both written and cognitive) be used to determine and document student skill performance. (For further information on the topic of criterion-referenced assessment, an ERIC search is suggested.)

In some cases, skill standards can be clustered so that multiple skill standards can be assessed at the same time. A caveat, however, is that the more skills to be assessed in a single clustered assessment, the more complex the assessment and related scoring. This was noted by Border (1998) in her review of the WestEd Career-Technical Assessment Program (C-TAP) in California.

If the product of skill standard performance cannot be readily measured, then the performance process elements or steps must be checked to insure competent performance. The assessment must identify conditions, constraints, and instructions to the student, and it must describe competent performance. The assessments must also include instructions to the evaluator. The development of valid and reliable assessment processes and instrumentation is a complex issue, beyond the scope of this monograph. Given the accountability requirements of the 1998 Carl D. Perkins federal vocational legislation, many states and localities are grappling with this challenge at this time.

Once the assessment process and instruments have been identified, the next step is the development of the content delivery system the student use curriculum materials.

Develop/Adapt/Adopt Instructional Materials

The first step in the curriculum development process is to conduct a search for curriculum that has been developed for the occupation or industry that relates to the standards set of interest. Extensive resources have been committed to curriculum development over the past 25 years, and there is a large amount of curriculum material available in vocational-technical education. Although the number has decreased significantly in the last 10 years, some states still have a curriculum development center or individual at the state level responsible for curriculum. Therefore, in addition to searching ERIC and the Internet search, the state department of vocational-technical education must always be contacted to determine what exists in the state, or how state-level contacts might be of assistance in locating existing curriculum materials. A phone number for the office of each state director of vocational-technical education is included in Appendix B. To verify these numbers, go to the National Association of State Directors of Vocational Technical Education Consortium website <http://www.iris.org/~nasdvtec/ main.html>.

Given that the amount of curriculum development conducted is directly related to cost and time, existing resources must always be reviewed to determine what might be usable. In curriculum development, there are three basic levels of cost/time commitments. First, "develop" is most costly in time and dollars; "adapt" is a happy medium in time and cost; and finally, the best alternative, if possible, is "adopt." By identifying existing material and adopting or making minor adaptations, the new or updated standards-based curriculum can be online and students can be productive in a very short time frame.

If curricula do not exist in the format or content desired for the program, then developing or obtaining student-use instructional material is the next step. In standards-based curriculum development, the use of instructional/assessment scenarios is an emerging trend. Scenario-based instruction is an extension of earlier contextual learning approaches that include project-based learning and "instructional modules." Small learning segments are prepared for student use, providing "chunks" of meaningful learning that can be quickly modified. With rapidly changing technology and the move to career pathways or clusters at the secondary level, this type of curriculum development and instructional delivery has many advantages, with flexibility as the major benefit. Scenarios provide a context for the delivery of skill standards content, and they also lend themselves to the use of the Web to deliver and modify the scenarios (see http://www.skillsnet.org/vtecs/index.htm).

Given the trend in many states toward the use of scenarios as a replacement for traditional curriculum, this monograph emphasizes scenario development rather than classic curriculum development systems documented in ERIC and numerous textbooks. The next chapter provides detail and tools for the development of instructional/assessment scenarios.

Review and Revise Curriculum on an Ongoing Basis

The rate of technological change and its potential impact on vocational-technical curriculum are phenomenal. It is also true that regardless of the quality of a program, continual review improves the experiences gained by students participating in the program. The program advisory committee is a major factor in program review. The feedback they provide, when coupled with instructor observation of student performance, will be a key to what and how much revision is required. The curriculum must be reviewed annually to identify standards changes that are occurring in the industry or occupation and to make the appropriate changes to the program. Instructor review of student performance relative to program skill standards triggers the need for content revision. Continuous review and recycling is a major activity in standards-based curriculum development. If review is diligently conducted, the standards-based program will provide learning experiences that will meet the students' needs immediately and in the future.

Rating Student Performance

In most education systems, assessment and rating of student performance continues to be a fact of life. Renewal of the curriculum, based on standards, will not change this instructor responsibility. Additionally, where some type of skill certification is in place, certificate reviewers need to see the criteria used in awarding the certificate. An example of a simple standards-based rating system (many systems are similar) uses the following scoring rubric:

0 = No Exposure. Observes only.
1 = Attempt only. Unable to meet performance standard criteria and/or requires significant assistance.
2 = Partially Demonstrated. Meets some of the performance standard criteria with or without assistance.
3 = Performance Demonstrated. Meets performance standard criteria without assistance at least once.
4 = Mastered. Successfully applied performance standard to solve related problem independently. Works independently without constant supervision.

Given that these rating numbers indicate "employability readiness," they are not designed as grades. This performance rating system is included in the V-TECS CONNECT program software designed to assist in the management and reporting of work-based learning programs.

For those skill standards in which the student did not demonstrate a level 2, 3, or 4 performance, no indication of performance would be included on the final report. In addition, a grading procedure might include identifying the percentage of time required to perform the skill standard competently compared to the average time required; identifying the number or percentage of total skill standards the student mastered compared to the entry or program-level requirements; or factoring attendance, work habits, and other work-related components into the final grade. In some instances a percentage may be adequate, although a percentage immediately raises the question of which or what part of the standards were not adequately performed.

If at all possible, a listing of skill standards competently performed at the time the student leaves the program provides the best information for employers and students. A search of databases such as ERIC can identify grading and performance rating systems that might have utility in a specific circumstance.

Contextual Instruction and Scenario Curricula

Contextual Instruction

Numerous authors, including Bailey (1998), Bottoms and HSTW Staff (1997), Raizen (1989), Smith et al. (1998), and Stasz et al. (1993), report that contextual instruction provides significant improvements in learning and retention of instruction among learners of all age groups. Contextual instruction provides for the improvement of both academic and vocational-technical instruction, for these reasons:

> Vocational-technical instructors can ensure that the required academic content is included or embedded in their instruction. This provides opportunities for academic skill reinforcement for students enrolled in the occupational preparation program and gives assurances to employers that the required academic content is covered in the program. Academic instructors have a demonstrable context for academic instruction, provided by instruction that has more utility to the learner and is more robust as a learning tool for the majority of students. The role of vocational-technical education in helping students learn, retain, and achieve the state's academic content standards is further defined.

Skill standards provide a natural content base for contextual instruction, given the skill standards' relationship to business and industry, and therefore, the real world that most students will ultimately enter. Simply stated, contextual instruction provides opportunity to develop materials that involve the world of work, not a synthetic or academic context, but one that is ideally related to business and industry skill standards. Standards-based scenarios are not abstract applications, but rather, applications that learners (regardless of age) can identify as "real."

The National Alliance of Business (1999) states:

> Increasingly, the business community is working actively with educators and trainers to articulate changing market needs and skill standards and to demonstrate flexible, rapid-response solutions to preparing people for tomorrow's business environment. This communication takes many forms, from supporting higher academic standards and contextual learning to asking recent graduates for school transcripts.
>
> This employer involvement signals that the business community views academic and real-world learning as critical factors in students' success. (p. 4)

According to Klein et al. (1997):

> Case study visits suggest that few educators have the technical background to deploy these industry-specific skills in the classroom. Specifically, academic teachers often teach their subject area disciplines without reference to the workplace, in part because textbooks and other instructional resources often ignore the relationship between schooling and work. (p. 7)

The quickly changing content of work requires a modular approach to curriculum. Scenario-based instruction provides a rich context for the integration of academic and vocational education. An additional benefit is the ability to update quickly or supplement existing materials with new scenarios as skill standards reflect changes in work. Scenarios also lend themselves to Internet delivery and provide instructional tools that can be used by large numbers of instructors, both academic and vocational.

Scenario-Based Instruction

Changes in funding practices at the federal level have had a significant effect on the development and delivery of vocational curriculum materials over the past 20 years. Differing philosophies have resulted in changed funding models from grants to states for the support of large curriculum research and development efforts to significantly increasing the funding that goes to the local level. In the majority of instances, local vocational education deliverers are responsible for obtaining or developing the curriculum that is used in their vocational programs. As a result, in most states, student-use curriculum materials are primarily privately published textbooks, with limited supporting material developed by the local instructor.

As a reflection of funding changes, quickly changing technology, and the impact of clustering at the secondary level, there is an increasing emphasis on the development of instructional materials that are modular and media based and can be quickly modified to reflect changes in content of the delivery system. The rate of change, combined with the increasing use of the Internet in both the development and delivery of instructional materials, has increased the use of instructional/assessment scenarios as a vehicle for meeting the needs of large groups of diverse learners. Scenarios, one type of contextual learning, provide vehicles for including content from various disciplines in the same instructional experience, thereby enriching the learning experience and providing the demonstrated benefits of contextual instruction. Case studies are another type of contextual learning. The primary element of a case study (the case) has similarities to the workplace context of a scenario. In most instances, however, specific academic and workplace skills, and scoring rubrics or criteria are generally not included in a case study.

With increasing academic credit requirements for high school graduation, in many states there has been a decrease in the amount of time allocated to vocational education at the high school level. This reduction in vocational education

has been targeted at preparation for specific occupations, and is resulting in greater emphasis on broader skill set preparation. At this time, various clustering techniques are being used by states, including Career Clusters, Career Pathways, Career Academies, or other skill clustering schemes. Scenario-based instruction can be used in all vocational program structures, including cluster-based and more traditional occupationally specific programs.

> Scenarios offer the opportunity for students to use a combination of technical skills, workplace skills, related academic skills, problem-solving, creativity, and other higher-order thinking skills to solve the problem posed in the scenario assessment. The problems posed are from real-world situations in business and industry, communities, and other settings. (Border 1998, p. 36)

Border identifies several types of scenarios that have been produced for instruction and assessment, including the V-TECS prototype in Appendix C.

Numerous entities have conducted extensive development and implementation work in the use of scenario-based instruction as a tool for instruction and assessment, and in many instances, integrating vocational and academic content. Included in these groups is WestEd in California, where Dr. Sri Ananda has led extensive scenario development activities <http://www.wested.org/>. Dr. Joyce Malyn-Smith at the Center for Education, Employment and Community at the Education Development Center Inc. <http://www.edc.org/> has published numerous papers and led workshops on the development and implementation of scenario based instruction. Dr. Chris Olson <http://www.mfglinks.org> developed and implemented a scenario-based assessment system for student and worker skill certification in the state of Indiana. Indiana developers use a software system called "PROFS" to develop their scenarios in conjunction with business and industry, which provides a high level of content validity to Indiana assessment scenarios.

One of the new tools being used to enhance contextual instruction and scenario development is The Linkage System® (Losh 1998), developed to provide resources for contextual instruction and scenario development. The system is designed to link academic content standards and occupational-vocational skill standards, and it provides support of the Internet-based Virtual Scenario Tools™. The standards linkage process is as follows:

- Analyze the state-adopted academic content standards to identify the applicable ***Taxonomy*** skills and establish a state content standards database "cross walk."
- Analyze occupations, vocational program content, or skill standards to identify the ***Taxonomy*** academic skills required for competent performance. These are called the "related/required academic skills" (RAS).
- Analyze occupations or vocational program skill standards to identify the ***Taxonomy*** academic skills required for competent performance, and then crosswalk the occupational RAS to state academic content standards.

- Load analysis results in web-based software system for instructor/developer use. Use the Virtual Scenario Tools™ to adopt/adapt/develop scenarios for instruction and assessment.
- Develop web-based Virtual Scenarios for instruction and assessment. Access the Virtual Scenario Tools™ website <http://www.skillsnet.org/vtecs/index.htm> for Linkage and Virtual systems.

The Linkage System® (Losh 1998) links academic content to skill standards for curriculum development. The Virtual Scenario Tools™, an Internet-based scenario development, banking, and retrieval system, will provide the following capabilities and resulting benefits to users:

- Provide for Internet (online or offline) based development of instructional/assessment scenarios with a business and industry skill standards context. These scenarios also include academic and workplace/SCANS (Secretary's Commission on Achieving Necessary Skills) skills.
- Provide a systematic process for "banking" (storage and retrieval) of instructional/assessment scenarios on the Internet or CD-ROMs. Users can search the site using academic or technical skill terms to identify existing scenarios to adapt or adopt.
- Provide Internet-based tools to link a state's academic content standards, skill standards, and scenarios that support student performance in an integrated manner.
- Provide a powerful set of Internet-based tools for the integration of vocational-technical and academic instruction.
- Provide evidence of vocational/technical/tech-prep course academic skill attainment support.
- Provide support for all learners' academic and technical skill attainment.

Additional materials are provided in Appendix C for user-conducted scenario development workshops.

Scenarios: A Tool for Integrating Academic and Vocational Education

In vocational-technical education, federal legislation has called for increasing the integration of academic and vocational education. This has proved to be a significant challenge for instructors, both vocational and academic. The challenge has been the identification and linking of both technical and academic standards in a context that is useful to instructors. Scenarios, given their modular format and the facilitation of joint local development, provide for the integration of both academic and vocational content, using a rich environment for acquisition of workplace, academic, and technical skills. Much work has been accomplished in moving scenario development forward, and the previously identified developers have influenced the model and developmental system and tools described in this monograph.

Including skill standards and state academic content standards in a scenario context provides two significant benefits. First, the use of industry-based skill standards provides a state-of-the-art context for vocational-technical program content. Second, scenarios provide an ideal setting for identifying, delivering, or reinforcing state academic content standards, for which all students will be required to demonstrate proficiency. Scenarios can be customized to include the states' academic content standards or specific academic skill statements such as those identified in the ***Taxonomy***.

Academic instructors also find useful these scenarios developed around national or state skill standards. The real context gives them the ability to answer the perennial question, "Why do I need to learn this (academic skill)?" as students struggle with an abstract or nonexistent context for academic skill content. Scenarios that include the technical, academic, and workplace skills needed for success on the job, either immediately or after a post-high school experience, can provide a valuable tool for integrating and improving instruction for all students.

Scenario Development

Scenarios can be developed for instructional or assessment purposes. The scenario model presented in this monograph has utility for both purposes, but is essentially an instructional or curricular tool. As an instructional tool, the primary developers are instructors. The products of their work are materials that can be used in their classrooms, shared with other instructors, and modified to meet the needs of other vocational programs.

Although scenarios, as well as all curricular and instructional materials, can be developed by individuals or groups, this monograph provides tools designed for professional development workshops offered one or more times every year in all schools. Professional development or inservice programs are the traditional method of getting new materials and concepts to instructors, and scenario development, as an inservice activity, yields usable materials in as little as a 2-day workshop. Obviously, longer sessions yield more materials, and continuous focused professional development over the school year(s) has the most lasting impact on the way instruction is actually delivered in the classroom, shop, or lab.

Ideally, the scenario development team consists of business/industry advisory committee members to provide real context for the scenario, and academic and vocational teachers to provide a cross-fertilization of content. This mix gives both of the disciplines greater awareness of what the other can provide and how the content areas interrelate to improve student instruction. Scenario development can provide a venue (one of the few) that actually facilitates the integration of academic and vocational education, as required by federal legislation. One of the major problems in developing student-use curriculum is the need to adjust the materials to the instructional environment. A scenario that is developed or modified by the instructor who uses it compensates for the quirks of each instructional venue. Additionally, scenarios can be endlessly modified to meet the needs of special education students. The content included, and the complexity, can be

modified for delivery to all students. Scenario development workshops can address the real world of schools, which includes instructors from junior high industrial arts, traditional high school home economics programs (now family and consumer sciences), and occupationally specific trade and industry programs. By discipline grouping, instructors are able to develop scenarios around skill standards and occupational task lists, or identify tasks appropriate to home makers or junior high students. Use of the scenario models provided in Appendix C and the scenario review criteria found in Appendix D provides instructors with the capability of scenario development from industry-based and validated skill standards as well as tasks and standards that are "home grown."

Developing scenario curricula requires a systematic approach, as does all curriculum development. The system identified by this author includes the following steps:

Obtain relevant task listing/skill standards set
Convene a review committee from local business/industry
Identify the tasks/skills to be included in the program
Develop instructional/assessment scenarios, including academic and workplace skills required to perform the scenario
Establish an assessment process
Develop a skill certificate
Grant certificates of demonstrated performance

Note: Materials associated with delivering a scenario development workshop (except the skill, academic, and workplace standards) are included in the Appendices for use in inservice sessions.

Although skill certification is not necessarily a part of or requirement for the development of a scenario-based instructional system, certificates that identify the skills mastered by students provide a valuable addition to their portfolios or other record sets. This type of documentation is becoming more prevalent, indicating to others (and to the student) specific skills the student has successfully performed. An example of the value of this type of certification is in the state of Indiana, where Skill Certificates signed by the Governor, granted after a scenario-based assessment, have value in entering higher education institutions in Indiana. For further information on this certification process, contact the Indiana State Director of Vocational-Technical Education (Appendix B).

Skill Standards *Scenario Planner*

This "*Scenario Planner*" is suggested for the development of scenario based curricula and instructional materials for the 21st century. This model includes the elements required for a high-quality instructional system when coupled with an instructor's existing classroom/lab management techniques. A primary hands-on tool for the scenario developer, be it an individual or a team, is a device to cue the developer as to the desired content of the scenario. For this system, the ***Skill Standards Scenario Planner*** includes the following topical areas to be addressed

by the developer. An example of a completed *Scenario Planner* is included in Appendix E, and a blank planner is in Appendix F to be copied for scenario development workshops.

Skill Standards Scenario Planner

Scenario Title _____

Date _____

The Scenario Title and the Development Date

The title of the scenario should be short, but convey the content of the scenario so that the reviewer can determine, be it broadly, the general area of concentration. Titles might include Develop and Conduct a Safety Review Program, Identify the Cause of an Automotive Braking Problem, Design an Irrigation System for an Oriental Garden, or an infinite number of other possibilities depending on the area of emphasis.

Skill Standards/ Tasks Included in the Scenario (List)

The skill standard(s) addressed in this scenario is identified here for learner use. This is the crucial first step in the development of the scenario, as it will determine the complexity and time required to perform the scenario. The general rule is to include only those skill standards or tasks that would normally be performed as part of a larger activity. The skill standard content will also be driven by the structure of the skill standards used, given the variance in skill standards sets discussed earlier in this paper. The inclusion of a large amount of content in the scenario is to be avoided, given that the larger the content, the more difficult to accurately assess performance and to indicate the quality of performance of all the skill standards. A rule of thumb, once again, would be to review the standards set and include only those standards that would normally be included in the development of a product or completion of a process. A primary source is the National Skill Standards Board <http://www.nssb.org/>. An additional source is the Virtual Scenario Tools™ website <http://www.skillsnet.org/vtecs/index.htm>, which is designed as a search resource for business and industry, state, and national standards.

Workplace Context/ Situation

This area of the *Scenario Planner* provides the work-based context for the standards addressed. In this section, the student is presented an actual problem to be solved, and the work-based context of the problem is included for the student's information.

Generally, this section will start with a statement such as "You work at (scenario developer provides the context) as an entry-level worker. Your job title is (scenario developer provides a specific example such as [job] assistant, [job] appren-

tice, etc.)." The context of the scenario will be directly related to the skill standards identified earlier in the scenario. The next portion of the situation provides the actual challenge or problem that exists in the workplace that the student (or team of students) needs to solve. This must be an actual event that a beginning worker might be asked to analyze and solve, either individually or as a team member. The problem, when coupled with the actual workplace environment provides the contextual instruction power of the scenario. This section of the scenario will provide for inclusion of "All Aspects of the Industry," another Perkins requirement. Finally, the time required to complete the scenario must be identified, so both the performer and the evaluator will have guidance as to performance expectations.

Academic Skills Required (Math, Language Arts, Science)

In this section, the academic skills required to perform the scenario are identified. Ideally, academic instructors would be part of the development team and would play a major role in the development dialog identifying the skills. They would use the developed scenarios in their instructional program for contextual instruction. These skills need to be specific. It is not adequate simply to state that reading or math is required. The type of reading and the specific math and science skills required must be identified. If other academic skills such as social studies, art, or foreign language are required or reinforced by the scenario, they also need to be identified. The two basic tools for this identification will be either the ***Taxonomy***, or the state academic content standards skills that are reinforced or required for scenario performance. Many state academic content standards are so broadly stated, however, that the developers will need to be more specific and turn to a recognized resource that provides the required specificity. The academic skills must be clearly documented to support the academic vocational integration documentation requirements.

Workplace Skills (Teamwork, etc.)

This section will include the workplace skills such as teamwork, communicating with customers or associates, and other skills found in numerous workplace skills documents such as SCANS (1991), the ***Workplace Skills*** (Southern Association of Colleges and Schools 1998) developed by the State of Illinois, and other commercial and public materials. It is critical that these types of skills be included, because employers often cite the lack of such skills as a reason for employee termination.

Scenario Set-up Directions for the Instructor

This section includes directions to the instructor on setting up the scenario conditions or "givens." Set-up includes technical publications, equipment, safety, and other materials/conditions that are required for the student to perform the scenario. This must be clear to another instructor in the same area and to a student attempting to perform the scenario. Setting up the environment for a scenario is a crucial component of providing the context for the student to perform the scenario. If product or process specifications manuals, tools or equip-

ment, or other "givens" are required for competent scenario performance, they must be identified. Since one advantage of scenario-based instruction is transportability, other instructors who use the scenario must be able to replicate the performance environment.

Performance Criteria/Assessment Rubric/ Checklist

This section of the planner identifies the criteria for successful scenario performance. This section tells the learner the criteria that will be used to assess the demonstrated performance. The national or state skill standards identified for inclusion in a scenario should have indicators of acceptable performance incorporated as part of the standard. The scenario developer can use these as the basis, or in some instances, they are inserted directly into this section of the scenario. In the event that the skills identified for the scenario do not have predetermined standards, the developer must identify what constitutes acceptable performance. Providing detailed criteria for determining scenario performance is critical. One of the major challenges of instruction and assessment of this type is reliability of the performance ratings between instructors or evaluators. The specific subsets of the overall performance that are critical or differentiate levels of performance must be identified. Where a certificate is granted that may affect an employer's decision to employ the holder, it is critical that variance in evaluator ratings be minimized through the development of detailed rubrics that can be used to assess and mark performance. If the student is to be granted a skill certificate as a result of performance on a set of scenarios, Border (1998) suggests the inclusion of a written exam over the same material covered in the scenario or set of scenarios. Inclusion of a written exam increases the reliability of the scoring of the scenario. In all instances, the student must clearly understand what is included in the performance expectations and how he or she will be evaluated by the performance criteria. To help the scenario developer, examples of scenarios are included in Appendix C.

Development Team

The final area to be completed in the Scenario Planner is the identification of the development team members. This should include the job title of team members, since, as indicated earlier, involvement of business/industry advisory committee members on the development team provides valuable input.

The Scenario Development and Review Rubric

To help the developer or user of predeveloped scenarios, Instructional/Assessment Scenario Criteria with accompanying ratings are included in Appendix D. This criteria sheet includes the following scenario topics or areas that the developers/ users need to consider as they initiate a scenario-based instruction process.

The first area to review is the skill standard(s) included in the scenario. For scenarios that are related to vocational programs that provide work force skills, the identified standards should relate directly to the skill preparation in that program or industry cluster. Regardless of the specificity of the program, occupation-specific or business/industry cluster of some type, the skill standards should be directly related and measurable. If no skill standards are identified, then the scenario will need to be analyzed to determine what skill standards the developer was attempting to address. For this area, the range is from "not specified" to "definitive and measurable."

The second area of quality review is how well the workplace context of the scenario is identified. This is a critical element since the performer must recognize this as an environment that reflects the real workplace rather than an academic exercise. The range of the review is from "the context does not reflect a realistic workplace" to "the context is realistic as stated in the scenario."

The third area deals with the problem provided to the student for his or her solution. The problem must not be trivial, since this is the area in which higher-order thinking skills must be required for its solution. The richness and complexity of the problem will relate directly to the learning that can be ascribed to the scenario. The range for this area is from "the scenario problem is not clear or is trivial" to "a problem is clearly stated, of substance, and the learner has no questions." This area will require considerable effort, given that the level of problem posed to the learner will ultimately relate directly to the credibility of the scenario and instruction based on it. Connected to the context and problem is an identification of the time allocated to perform the scenario. The time to perform is a matter of developer judgment, based on the skills included in the scenario. Clearly, for those scenarios with numerous skills, more time will be required. Additional factors affecting time considerations are the amount of time available to perform, and the type of performance individual or team.

A clear identification of the academic skills required to perform the scenario competently is the next area of review. In this instance, the academic skills that are listed may be reinforced through the scenario, or in the instance of an academic instructor, the scenario may be the primary instructional tool. The academic skills stated in the scenario must ultimately be linked to the state academic content standards. The skills can either be stated as found in the ***Taxonomy***, or as found in the state content standards. If they are stated in the Taxonomy construct, they can then be translated to any user's academic content standards. The rating scale ranges from "no academic skills are identified" to "the state academic content standards reinforced (in the scenario) are identified."

When individuals are not able to hold or advance in jobs, a probable reason is a deficiency in workplace skills. Workplace skills include interpersonal relationship skills with associates, supervisors, and supervisees. It is clear that regardless of the discipline, working with other people is a major part of all jobs. Much research has been conducted, and many publications exist that provide documentation and identification of workplace skills. Among these publications are the SCANS documents put out in the early 1990s by the Department of Labor (SCANS 1991,

1992), the workplace skills and related assessment items developed by the State of Illinois (Southern Association of Colleges and Schools 1998) and adopted by V-TECS, and the Arizona workplace skills developed in the mid-90s. Numerous other states and private companies have published similar materials, and an ERIC or Internet search should show numerous sources for these skill statements.

In addition, scenarios that emphasize workplace skills using skill standards can play a role in the overall vocational curriculum, providing increased reinforcement of these skills. The ratings for this area range from "no workplace skills are identified" to "includes skills and assessment rubric for the necessary skills."

The scenario must include Scenario Set-up Directions for the Instructor. For the student to be able to solve the problem presented, any tools, manuals, policy guidelines, charts or other resources required must be clearly identified. In some instances, this list will be short; in others, quite lengthy. As usual, this list depends on the skill standards addressed, the context of the problem, and the actual problem to be solved. The ratings for this area range from "no instructions are included" to "scenario set-up and performance evaluation instructions are clear and unambiguous."

Student evaluation using anything beyond classic written examinations is always a challenge. The identification of the criteria of proficient performance is critical for the reliability of performance ratings. For the skill standards covered in a scenario, the standards of proficient performance would be shown in this section. Users of skill standards and the developer of scenarios should always seek out skill standards sets that include measurable standards and avoid skill standards sets that have broad skill statements with no or marginal standards performance criteria. The standards must be clear to the student, providing for clear communication of expectations. For this area, the range is from "no performance criteria is identified," to "performance criteria or assessment rubrics are listed and clear to learner."

Finally, the developer must ensure that the scenario is *gender, culturally, and racially neutral*. Problems in any of these elements render the scenario unacceptable and must be corrected prior to use. The range for this topic is from "includes references, terms, or words associated with gender, culture, or race" to "no references, terms, or words associated with gender, culture, or race."

Conclusion

The development of curriculum materials using valid and reliable skill standards has the potential of improving the quality of both academic and vocational-technical education. This will occur, however, only if vocational-technical educators carefully pursue high-quality standards sets and implement them in their programs. Skill standards are produced by many entities, with business, industry, and labor being the primary provider of national and state skill standards. Ultimately, the National Skill Standards Board (NSSB) and their voluntary partnerships will use criteria (under development at the time of this monograph) to identify skill standards sets that can be called "National Skill Standards." There are presently de facto national skill standards in some areas, but none recognized by the NSSB.

Skill standards provide the information needed to direct curriculum development efforts to the latest technology and techniques of business and industry. Both academic and vocational-technical curricula, using either traditional processes and materials that have been developed for many years or more recent innovative delivery practices, can benefit from the adoption of a standards-based system.

The integration of academic and vocational education has been mandated at the federal level since the early 1990s, and reinforced in both the school-to-work legislation of 1994 and the most recent iteration of the Carl D. Perkins legislation. The use of scenario-based instructional materials that integrate skill standards and academic content standards shows promise in providing tools that can help meet this goal.

This monograph includes information and models for the user to develop and conduct continuing education workshops for the development of standards-based instructional scenarios. These field-tested tools provide a valid base for the knowledgeable workshop leader in the development of instructional scenarios at the local, state, regional, or national level.

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Items with ED numbers may be ordered from the ERIC Document Reproduction Service, 7420 Fullerton Road, Suite 110, Springfield, VA 22153-2852; 703/440-1400; toll-free (United States and Canada): 800/443-3742; fax: 703/440-1408; e-mail: service@edrs.com; http://edrs.com

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Appendix A
Sample Skill Standards

An Excerpt from the V-TECS Heating, Air Conditioning, and Refrigeration Technician National Skill Standards Publication

F022 **Skill**: Calibrate thermostat and set heat anticipator.
Standard: Thermostat must be calibrated according to manufacturer's specifications. Calibrated thermostat must respond to space temperature in which sensing element is located, heat anticipator must function to specifications, and thermostat must control air conditioning equipment to provide desired space temperature. Applicable safety procedures must be followed.

An Excerpt from the State of Illinois Horticulture Standards

Go to <http://www.standards.siu.edu/> for complete sets of numerous standards.

Identify, Record, and Process Damaged and Poor-Quality Merchandise

SKILL STANDARD

CONDITIONS OF PERFORMANCE

Given company policies and procedures and the following equipment and materials:

Plant merchandise (fresh flowers and foliage)
Hardscape merchandise (vases, gift items, plants, dried plant material)
Records and forms
Price marking equipment and materials

WORK TO BE PERFORMED

Identify and record poor-quality, damaged, and incorrect plant materials and hardscape merchandise; and process the merchandise according to company policies and procedures.

PERFORMANCE CRITERIA

Poor-quality, incorrect or damaged plant materials and merchandise and merchandise within designated "sell by" dates are correctly identified and recorded; and materials and merchandise are correctly processed (e.g., pricing, disposal) according to company policies and procedures

An Excerpt from the V-TECS Business Management Occupations Skill Standards Publication

Skill: Develop an annual strategic plan for an ongoing business.

Standard: Given a situation where you are considering expanding your business by adding a new product line or by opening a second location, develop a strategic plan for this expansion. The plan must include the following: 1. Evidence that data about the existing business, its competitors, government regulations, and the economy have been reviewed and considered in developing the plan. 2. Goals and objectives with perceived outcomes and target dates for the revised business. 3. Costs and required resources. 4. Cost comparison of expansion versus opening a second location. 5. Identification of sources of funding, considering forecasts of revenue from expansion.

An Excerpt from the Concrete Worker Skill Standards Laborers-AGC Education and Training Fund

Vertical Concrete Construction: Placement

Conventional Industry Standards

1. Lifts must be uniform within +\- 3" (76 mm) over 20' (6.1m) horizontal throughout the "course."
2. Concrete must be placed evenly to avoid excessive pressure in one form area.
3. Concrete must be vibrated evenly until air bubbles cease appearing on the surface.
4. Vibration must stop before the mortar and aggregate separate.
5. Concrete must be consolidated approximately 18" (.46m) into the previous lift to ensure bonding and avoid cold joints.
6. Avoid more than one, 1"(25mm) honeycomb within 48 sq ft (14.63m2)

An Excerpt from the Kentucky Manufacturing Skills Standards Level 2 Advanced

II. Math and Measurement

AA2 Academic

AA2.1 Distinguish between direct and calculated measurements
AA2.2 Compute calculated measurements

AO2 Occupational

AO2.1 Describe measurements' role in manufacturing
AO2.2 Demonstrate proper precision measurement techniques
AO2.3 Describe the appropriate application and use of precision measurements in manufacturing

AO2.4	Explain calibration requirements of various precision instruments
AO2.5	Illustrate measurement differences when taken with calibrated and noncalibrated instruments
AO2.6	Match appropriate measurement tools with various types of measurement requirements
AO2.7	Demonstrate proper measurement tool usage
AO2.8	State selection criteria for measurement tools
AO2.9	Interpret results of measurements and calculations
AO2.10	List steps with rationale of proper measurement procedures
AO2.11	Distinguish between general and precision measurement

The following three skill standards examples were extracted from the Occupational Skill Standards Projects found at the NSSB website, http://www.nssb.org/

Example 1.
Author: Foundation for Industrial Modernization (FIM)
Title: National Skill Standards Project for Advanced High Performance Manufacturing
Source: Washington, DC: National Coalition for Advanced Manufacturing, 1995

An example of a skill standard might be—

> Working alone with a calculator, add 10 two or three digit numbers five times in 3 minutes with 100% accuracy, in order to perform necessary calculations for Statistical Process Control (SPC) during the manufacturing process. To be documented by third party or performance assessment.

Example 2.
Author: Electronic Industries Association and Electronic Industries Foundation
Title: Characteristics of Competency: Measurement Criteria for Entry-Level Electronics Technician Skills
Source: Washington, DC: The Foundation of the Electronic Industries Association, October 1995

II. Technical Skills
The standards in this section are based upon the worker's ability to know the technical basis for and be able to explain how a product, device, circuit, or procedure works; to be able to apply that knowledge; and, as appropriate, to fabricate, demonstrate, troubleshoot, repair, or replace the product, device, or circuit.

Included in Technical Skills are—

A. General Skills
B. DC Circuits
C. AC Circuits
D. Discrete Solid State Circuits

E. Analog Circuits
F. Digital Circuits
G. Microprocessors
H. Microcomputers

Many entry-level workers have difficulty troubleshooting a device to identify and locate a problem. They do not seem to understand what needs to be done, where to start, or how to proceed. Mastery of troubleshooting techniques as specifically defined in the skill standards should be incorporated into training.

Many students are being taught on obsolete equipment. They should have access to state-of-the-art test equipment and should learn on the same technologies they will see in the workplace. For example, they need to use printed circuits in place of "breadboards."

A. General Estimated training time: 50-70 hours

A.01 Demonstrate an understanding of proper safety techniques for all types of circuits and components (DC circuits, AC circuits, analog circuits, digital circuits, discrete solid-state circuits, microprocessors)
A.02 Demonstrate an understanding of and comply with relevant OSHA safety standards
A.03 Demonstrate an understanding of proper troubleshooting techniques
A.04 Demonstrate an understanding of basic assembly skills using hand and power tools
A.05 Demonstrate an understanding of acceptable soldering/desoldering techniques, including through-hole and surface mount devices A.06 Demonstrate an understanding of proper solderless connections
A.07 Demonstrate an understanding of use of data books and cross reference/technical manuals to specify and requisition electronic components
A.08 Demonstrate an understanding of the interpretation and creation of electronic schematics, technical drawings, and flow diagrams
A.09 Demonstrate an understanding of design curves, tables, graphs, and recording of data
A.10 Demonstrate an understanding of color codes and other component descriptors
A.11 Demonstrate an understanding of site electrical and environmental survey
A.12 Demonstrate the use of listening skills or assistive devices to assess signs and symptoms of malfunctions

Example 3.
Author: Center for Occupational Research and Development (CORD)
Title: National Photonics Skill Standards for Technicians
Source: Pittsfield, MA: Laurin Publishing Co., 1995

Accessories:

1. E-O MODULATORS AND Q-SWITCHES Clean, maintain, align, mount, install, operate and demonstrate E-O modulators and Q-switches.
2. A-O MODULATORS AND Q-SWITCHES Clean, maintain, align, mount and install A-O modulators and Q-switches.
3. MECHANICAL DEFLECTORS AND SCANNERS Clean, maintain, align, mount and install mechanical deflectors and scanners.

Analysis, Testing and Measurement:

4. POWER AND ENERGY METERS Clean, maintain, align, mount, install, operate, demonstrate, classify and identify power and energy meters.
5. MONOCHROMATORS Align, mount, install, operate, demonstrate, classify and identify monochromators.
6. MICROSCOPES Operate and demonstrate microscopes.
7. SPECTRUM ANALYZERS Operate, demonstrate, classify and identify spectrum analyzers.

Detectors:

8. SEMICONDUCTORS Calibrate, test, clean, maintain, align, mount, install, operate and demonstrate semiconductor detectors.
9. DETECTOR ARRAYS Calibrate, test, align, mount install, operate and demonstrate detector arrays.
10. DETECTOR AMPLIFIERS Calibrate, test, clean, maintain, align, mount, install, operate and demonstrate detector amplifiers.
11. CCD/CID Calibrate, test, align, mount, install, operate and demonstrate CCD/CIDs.

Appendix B
State Directors of Vocational Education 1999

http://www.iris.org/~nasdvtec/directors.html

Alabama
Dr. Nancy Beggs 334/242-9111

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Ms. Mary Lewkowitz 602/542-5212

Arkansas
Dr. Stephen B. Franks 501/682-1500

California
Mr. Stuart Greenfeld 916/657-2532

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Ms. Christine Johnson 303/620-4000 303/825-4295(fax)

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Wyoming
Ms. Rebecca Walk 307/777-7417

District of Columbia
Dr. Cynthia M. Bell 202/576-6308

Puerto Rico
Mr. Carlos Vasquez 787/758-4132

Virgin Islands
Ms. Anna Lewis 340/776-3484

Appendix C: Model Scenarios

Model Scenario 1

Scenario Title: Applying for a Job

Skill Standards/Tasks Included in the Scenario:
A1.4 Use correct spelling
A1.5 Write with accuracy, brevity, and clarity
E1.2 Organize materials with a logical flow
E9.8 Prepare a resume and letter of application of interest
A1.6 Keyboarding

Workplace Context/Situation: A friend of yours saw an announcement for an entry level industrial maintenance hourly employee at Ace Manufacturing, 202 West 2nd Street in Brandon, KY. Since you will be graduating from your technical program within the next two weeks you are actively seeking employment that matches your skills and abilities. Write a letter of application for this position to John Smith, Human Resources Director and attach a resume.

This scenario requires approximately 1 hour to complete.

Scenario Set-up Directions for the Instructor:

Provide students with a computer and software to develop their letter and resume.

Performance Criteria/Assessment Rubric/Checklist:

Use the following checklist to evaluate the student's performance. Place an "X" in the column to the right of each step to show that the student has passed.

Performance	Passed
Prepared one application letter keyed without error	
Included key points of job information in letter: a. Name and address of prospective employer b. Statement of interest in job c. Information about student including name, address, and method of contact.	
Prepared a resume keyed without error.	
Student information was correct and applicable to job requirements.	
Resume included: a. Full name, address, and telephone number of student b. Education, including related subjects studied c. Work Experience d. Technical Skills e. Honor/activities f. References	

Model Scenario 2

Scenario Title: Attendance and Being on Time is Necessary to Get the Job Done

Skill Standards/Tasks Included in the Scenario:

E9.2 Document regular attendance
E9.1 Demonstrate consistently punctual arrival

Workplace Context/Situation:

You are an employee of Ace Manufacturing as an entry-level worker in the plastics division. ou are working with a five-member team that has been assigned the task of evaluating a new piece of equipment. Within the next 3 days, the team must present, in writing, a consensus on the value of this equipment to your operation.

One of the team members, Jim, has only reported to work two of the last 6 days during this equipment evaluation. Another team member, Julie, has been late to work 3 of the 6 days and, thus is not aware of the full operation of neither the equipment nor its advantages and disadvantages. If the equipment is purchased, Jim will be the person ultimately responsible for operating it because of his skills and seniority in the department.

If you were the team leader, describe the process you would use to complete this report by the due date. In addition, write a letter to your supervisor describing the effects of irregular attendance and punctuality on the company. In the letter list at least three benefits and three consequences that can result from poor attendance or punctuality.

This scenario requires approximately 45 minutes to complete.

Academic Skills Required (Math, Language Arts, Science):
A1.4 Use correct spelling
A1.5 Write with accuracy, brevity, and clarity
A1.7 Knowledge of conflict and resolution techniques

Workplace Skills (teamwork etc.):
E1.5 Understanding team concepts
AA1.3 Contrast the roles of a team with the role of an individual

Scenario Set-up Directions for the Instructor:

Provide computer and software for typing letter

Performance Criteria/Assessment Rubric/Checklist:

Student described the task to be completed, the status of this task, complications and a process that would achieve the desired results within the time period.
Letter to supervisor was keyed without error.
Letter to supervisor included three benefits of maintaining regular attendance and punctuality
Letter to supervisor included three consequences if regular attendance or punctuality is not maintained.
Letter to supervisor was written with brevity, clarity, and accuracy.

Scoring Rubric:

1= Novice (Not Competent)	*2=Apprentice (Unacceptable)*
1. Process addresses some of the issues. 2. Letter to supervisor was written but contained errors and did not include appropriate benefits or consequences.	1. Process was briefly described but did not demonstrate importance of achieving results in desired time frame. 2. Letter to supervisor contained errors. 3. Letter to supervisor had only two benefits and two consequences listed.
3= Proficient (Minimal Competence)	***4= Distinguished (High Mastery)***
1. Process was described but would not achieve results in original time period. 2. Letter to supervisor was keyed without error. 3. Letter to supervisor included three benefits of maintaining regular attendance and punctuality 4. Letter to supervisor included three consequences when regular attendance or punctuality is not maintained.	1. Process was described to achieve the desired results within the time period 2. Letter to supervisor was keyed without error. 3. Letter to supervisor included three benefits of maintaining regular attendance and punctuality 4. Letter to supervisor included three consequences when regular attendance or punctuality is not maintained. 5. Letter to supervisor was written with brevity, clarity, and accuracy.

Model Scenario 3

V-TECS
VIRTUAL TRAINING & EDUCATION SCENARIO
Prototype

Manufacturing Linkage "CORE RESPONSIBILITY" Duties and Tasks:

0.1 ESTABLISHING CUSTOMER NEEDS

1.1.2 Review and document customer product specifications and other requirements using quality-planning tools.

2.3 MANAGING QUALITY SYSTEMS

2.3.1 Ensure that the manufacturing system meets quality system requirements defined by the business (e.g., QS9000, ISO 9000, and other customer and stakeholder requirements).

2.4 IMPROVING MANUFACTURING PROCESSES

2.4.1 Use company problem-solving systems to continuously improve manufacturing operations.

Required Academic Skills: LA 1, 2, 3, 4; MA 3, 6, 10, 11; SC 042, 280, 338, 499, 503

NOTE: *The applicable state's academic content standards could be displayed here if the state standards were crosswalked to the V-TECS Academic Skill Taxonomy*

V-TECS Workplace Skills: D001, 004; H 001, 003; M004

Related NACFAM Manufacturing Standards: BO 6, 7, 11; PC 2; WI 7; WH 2, 5, 8, 10; QA 1, 2, 3, 5, 6, 9, 10, 11, 12, 14, 16, 17, 18, 19, 20; MF 1, 2, 3, 4, 5, 15, 16; PS 2, 3,; CT 2, 4, 5, 9, 13, 14, 15, 17, 19, 20, 21, 22, 24, 26; MM 1, 2, 3, 4, 6, 20, 22; CU 5, 8; WS 6, 7, 13, 18, 21

Related O*NET Code: 83005A

Related North American Industry Classification System (NAICS) Code: 325510

Conditions of Performance:

Given the following:
Company procedures for making quality checks
Documentation on previous audits or results of company procedures
Process control documents or test results of a specific quality check
Product specifications
Standard forms, charts and materials for recording findings

Summary of Performance:

Utilizing data available to you, conduct an internal review for a production unit to determine its compliance with the company's quality system. Participant is required to use a standard industry model to conduct the review and present findings.

Performance Criteria:
Evidence was presented that the participant had completed the following steps for conducting a review and presenting findings:

1. Reviewed any previous audit information
2. Compared pre-audit information to departmental and company processes and requirements.
3. Monitored/reviewed current process as compared to written procedures
4. Charted or documented findings.
5. Considered various alternatives for correcting any problems.
6. Determined best corrective action and recommended a plan of action that includes timelines, personnel assignments and costs.

Student Instructions:

You are an employee of Pretty Paints. You have received numerous calls from customers indicating that Paint listed as Catalog No. 12345 is too thick and difficult to use. You have been asked to conduct a pre-audit of compliance with the quality procedures for the sampling of paint prior to filling. You have been given results of three tests made on this batch prior to filling and the formula with specs for that particular paint. In addition you have been given the procedures that are to be followed in checking for the quality of all paint products. Determine if the procedures were followed and document your findings and recommendations for correcting any problems in a letter to Mr. John Smith, the Quality Department Manager.

Teacher Instructions:

To set up this activity, you will need to provide student with the following information:

- Attached sheets giving test results of quality checks on paint
- Attached Formula and Spec Sheet
- Attached Company Procedures for conducting quality checks

Assessment Criteria:

Successful completion of the scenario includes the following:

1. A memorandum was written to Mr. John Smith that identifies that procedures were not followed.
2. The memorandum states that two tests did not conform to specs:
   a. viscosity above range, and
   b. weight per gallon above requirements. (The higher the viscosity the thicker the paint.)
3. The memorandum states that the paint was produced and adjustments were not made, either on the production line or in the formula, to correct the higher viscosity and the weight per gallon.

4. Recommendations are suggested that:
   a. results should be closely reviewed by both quality technician and by line supervisor prior to production;
   b. if test results are out of compliance with specs, then the lab and line supervisor should decide if they can make corrections and retest or do they need to notify developer of formula of problems so adjustments in formula can be made; and that
   c. written procedures are followed, or if needed, modifications are made in written procedures to conform to process being used.
5. Satisfactory performance on the associated written performance assessment.

Resource used in development of scenario:
Eric Petty, Quality Technician, ICI Paints, Cleveland, OH

Procedures for Paint Quality Control Tests Prior to Production

1. Fill pint can with sample of paint, which has been prepared according to formula and specification sheet for filling production.
2. In quality control lab, pull Formula Inquiry and Specification Sheet that describes the test description and instructions for running all tests on sample for this specific product.
3. Input into computer descriptive data about product such as catalog, formula, date, and batch number.
4. Run all tests as defined on Specification sheet.
5. Input results of each test in computer data about that sample.
6. Let paint sit overnight.
7. Run a second viscosity test and input results.
8. Printout results of tests and compare to Product Specification Sheet.
9. Make written comments about any results out of compliance with Specification Sheet.
10. Send copy of test results to Production Supervisor.
11. Discuss with Production Supervisor options for correcting or retesting.
12. If after two retests are performed, and results still indicate product is out of, compliance with specifications, then meet with product developers and have product rechecked at developing lab to see if specs or formula need to be changed.
13. If specs and formula are okay, then a review of the production process needs to be reviewed and any adjustments in this process must be made to meet product specifications.
14. Continue to retest until sample meets product specifications

TEST RESULTS **Pretty Paints Form 111**

12345 M FT3 SPECIFICATIONS Page 1 of 1

Catalog	12345
Formula	FT3
Date	11/08/97
Batch	4789
T-Date	F
Tank	
Theo Yield	900
Tank Yield	900

Viscosity	WT/GAL	GRIND	GLOSS	SAG	PH
75-85	11.00	P	P	40-60	7.5-8.5
92	11.42	P	P		7.5

2nd Viscosity
105-110
113

PRE-ADJUSTMENTS:
Additions and Comments:

User ID Smith Location 345

Date: 10/18/98

TEST SPECIFICATION

Sample Size: Steel Pint Can

Minimum	Maximum	Test Description/Instruction
75	85	1st Viscosity
105	110	Overnight 2nd Viscosity
10.50	11.00	Weight Per Gallon LBS/GAL
PASS		Gloss 3 or below
PASS		DRY TIME–1 hour to touch
PASS		TEXTURE (Grind Fineness) SMOOTH
		SAG 40-60
7.5	8.5	pH Measurement

Appendix D
Instructional/Assessment Scenario Criteria

1. **Identifies the industry skill(s) included in the scenario**
   0 = the industry skill(s) included in the scenario are not specified
   4 = the industry skill(s) included in the scenario are definitive and measurable

2. **Identifies the workplace context of the scenario**
   0 = the context of the scenario does not reflect a realistic workplace
   4 = the context is realistic as stated in the scenario

3. **Describes the problem to be solved in the scenario**
   0 = the scenario problem is not clear or is trivial
   4 = a problem is clearly stated, of substance, and the learner has no questions

4. **Identifies the time allocated for performance**
   0 = no performance time is listed
   4 = amount of time allowed for performance is clearly stated

5. **Identifies and lists the academic skills required to perform the scenario competently**
   0 = no academic skills are identified
   4 = the state academic content standards reinforced are identified

6. **Includes the workplace skills required for scenario performance**
   0 = no workplace skills are identified
   4 = includes skills and assessment rubric for the necessary skills

7. **Includes instructions to the instructor or performance evaluator**
   0 = no instructions are included
   4 = scenario set-up and performance evaluation instructions are clear and unambiguous

8. **Criteria of proficient performance are listed and unambiguous**
   0 = no performance criteria is identified
   4 = performance criteria or assessment rubrics are listed and clear to learner

9. **Scenario is gender, culturally, and racially neutral**
   0 = includes references, terms, or words associated with gender, culture, or race
   4 = no references, terms, or words associated with gender, culture, or race

Appendix E
Scenario Planner

Scenario Title Production Planning **Date** July 30, 1999

Skill Standards/Tasks Included in the Scenario (List):

- Control quality manufacturing system with other manufacturing systems.
- Identify effects of quality systems on specific manufacturing processes.
- Explain the effect of quality on profit.
- Locate and retrieve production materials specific to process flow and delivery schedule.
- Receive and communicate process flow instructions and deliver schedules.
- Apply a system of problem solving.
- Identify opportunities for applying problem-solving techniques.

Workplace Context/Situation:

You are an employee of Drinks, Inc. It is your job to order supplies and plan production to meet the needs of your customers without having too much on hand as the humidity in Florida will damage any overage that sits for longer than 2 weeks. A new employee did not realize that Owen's Food Market is on a continuous replenishment plan and therefore, it went unnoticed on the CRT that Owen's Food Market, one of your biggest customers, is extremely low in inventory. To complicate matters, the marketing department has just announced that a big promotion will take place on the 14 ounce bottles within the next four weeks at Story's, another grocery chain. This promotion will require special labels and twice the number normally supplied to Story's. You call a team meeting to discuss options for meeting both customers needs within their desired timelines and without a significant amount of unused material. Develop a plan for production that meets both customers needs as well as normal scheduled production.

This scenario requires approximately 9 hours to complete.

Academic Skills Required (Math, Language Arts, Science):

- Add, subtract, multiply and divide four digit numbers with the use of a calculator.
- Add, subtract, multiply, and divide four digit numbers without the use of a calculator.
- Apply basic math functions to solve problems.
- Create and interpret basic graphs and charts commonly used in manufacturing.

Workplace Skills (teamwork etc.):

- Demonstrate the ability to act in a polite and respectful way toward co-workers.
- Demonstrate the ability to complete tasks on time and accurately.

- Follow directions and procedures.
- Demonstrate a willingness to work.
- Plan and organize work.

Instructor/Evaluator Instructions:

To set up this activity, you will need to divide the students into teams and provide each team with the following information:

- Finished inventory of three different flavors on hand at this plant
- Current and projected finished inventory for Owen's Food Market
- Number required for the promotion
- Capacity of line and equipment; potential line utilization reports/data
- Shipping records: order fill rate; on time delivery reports; shipping/delivery stats
- Normal run schedule for production
- Line reliability schedule—preventive maintenance, flavor changes, history of unscheduled down time
- Staffing schedules
- Vendor information: list of vendors with history of delivery stats; costs of materials; quantity available for various products
- Package material and ingredient inventory on hand
- Company policies and procedures, guidelines (costs data, labor guidelines, quality issues, etc.)
- Order forms and inventory control records

Each team should develop a plan that meets the customer needs within company guidelines.

Performance Criteria/Assessment Rubric/Checklist:

Product Plan developed that meets customer specs within company policies and regulations. Plan is developed by completing the following steps:

1. Current inventory of materials (finished and packaged materials and ingredients) is accurately determined.
2. Number to be produced is accurately projected.
3. Orders are placed to accurately reflect material lead times for production schedule.
4. Changes are identified in the production schedule to reflect availability of packaged materials and ingredients and required output.
5. Compliance with company policies for costs, labor, materials.
6. Allowances made for equipment maintenance, any holidays, shipping schedules or other possible delays
7. Recommended alternatives as needed.
8. Plan meets customer needs without more than overage than can be safely stored in existing finished inventory for shipment and any extra packaged materials and ingredients can be safely stored and used within time specified by product specs.

Development Team:

Appendix F
Scenario Planner

Scenario Title _____
Date _____

Skill Standards/Tasks Included in the Scenario (List):

Workplace Context/Situation: You work at _____ as an entry-level worker. Your job title is _____.

This scenario requires approximately_____ to complete.

Academic Skills Required (Math, Language Arts, Science):

Workplace Skills (teamwork etc.):

Scenario Set-up Directions for the Instructor:

Performance Criteria/Assessment Rubric/Checklist:

Development Team:

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